

STUDIES IN THE CARYOPHYLLACEAE—II. *ARENARIA*
NUTTALLII AND *ARENARIA FILIORUM*,
SECTION ALSINE

BASSETT MAGUIRE

A densely caespitose, low, gray-green plant growing in the rocky embankment of the road-cut caught our eye from the moving car, while Professor Holmgren and I were crossing the low pass of the Shoshone Range during the past field season in southern Nevada. The plant, just coming into flower, had the habit of the Montana and Wyoming plains *Arenaria Hookeri*, but the delicacy and flower character of *A. Nuttallii*. On two other occasions we found this plant in fine condition in loose talus on sterile, partly denuded, low-altitude slopes, again further on in the Shoshone Range, and in the Toiyabe Range.

Critical study in the herbarium confirmed our field designation of the plant as *A. Nuttallii*, but necessitated a review and redefinition of the entire species, the results of which are presented herein.

1. *ARENARIA NUTTALLII* Pax, Bot. Jahrb. 18: 30. 1893. Perennial from a deep-set taproot; multicapital, the crown branches numerous, frequently matted, becoming ligneous, short, or if buried in loose talus extensive and much branched; stems leafy, less than 10 cm. high, weak and diffuse or more or less caespitose, erect and brittle, stipitate-glandular, more or less densely so upwards toward the inflorescence, scantily or not at all pubescent toward the base, rarely completely glabrous; leaves 5–10 mm. long, plane or acerose, subulate, pungent or abruptly apiculate, 3-nerved, strict or recurved and squarrosely spreading, the primary leaves broadly subulate, distinctly 3-nerved, abruptly pointed, the secondary usually acerose, indistinctly 3-nerved, the apex abrupt or pungent, the bases connate, particularly the lower long-sheathing, imbricate, or the upper internodes equaling the leaves; flowers few or many, sometimes reflexed, in spreading cymes, inflorescence more or less densely stipitate-glandular; sepals 3.5–6.5 mm. long, broadly to narrowly lanceolate, acuminate or pungently attenuate, 1–3-nerved, scantily or moderately glandular; petals shorter or conspicuously exceeding the sepals, narrowly or broadly elliptic, obtuse, or acutish; filaments slightly included, those opposite the sepals with a conspicuous basal gland; ovules several; capsules short, ovate-pyramidal, thin-walled, 3-(4)-valved, valves entire; styles 3 (4), slightly capitate; seed brown to brown-black, 1.0–1.3 mm. broad, 1.25–1.75 mm. long, papillae transversely elongate, low, the marginal more prominent.

Plants characteristically forming low dense mats, or sometimes caespitose, on talus or loose gravelly soil, foothills to alpine sites, in the mountains from Alberta and British Columbia south to southern California, Nevada, Utah, and Wyoming.

In the Great Basin, in the Sierra Nevada, and in the Siskiyou Mountains and nearby coast ranges three fairly distinct and restricted populations have been set off. These have developed differences primarily in sepal, petal, leaf-form characters, and to some extent in habit and pubescence. The remainder of the species from Oregon northward, and throughout its Rocky Mountain range, is polymorphous in these characters, and in many individuals is with difficulty distinguished from one or the other of the segregated subspecies. Within this major population, however, no recognizable variant has been cut off.

KEY TO THE SUBSPECIES OF *A. NUTTALLII*

1. Leaves ascending or strict, neither arcuate nor squarrose.
 2. Leaves abruptly acute or apiculate, infrequently pungent; sepals acuminate, midrib not prominent.
 3. Petals shorter than the sepals; Cascade Range, Rocky Mountains 1a. subsp. *Nuttallii*.
 3. Petals longer than the sepals; north California coast ranges, Siskiyou Mountains 1d. subsp. *gregaria*.
 2. Leaves strongly pungent; sepals narrow, pungently attenuate, midrib prominent; Sierra Nevada Range 1c. subsp. *gracilis*.
1. Leaves arcuate or squarrose.
 2. Sepals 3.5-5.5 (6.0) mm. long, lanceolate, sometimes broadly so, acuminate, 1-nerved (occasionally 3-nerved); petals shorter than the calyx; Cascade Range, Rocky Mountains 1a. subsp. *Nuttallii*.
 2. Sepals 5.5-6.6 mm. long, narrowly lanceolate, pungently attenuate, 3-nerved; petals more or less equaling the calyx; central Great Basin 1b. subsp. *fragilis*.

1a. *A. NUTTALLII* subsp. *Nuttallii* Maguire, nom. nov. *A. pungens* Nutt. ex Torr. & Gray, Fl. N. Am. 1: 179. 1838, as to type, not *A. pungens* Clem. 1816. *A. Nuttallii* Pax, in Bot. Jahrb. 18: 30. 1893. *A. Nuttallii* var. *gracilipes* M. E. Jones, Proc. Calif. Acad. Sci. 5: 626. 1895. *Alsinopsis occidentalis* Heller, Muhlenbergia 8: 96. 1912.

Leaves mostly strict and abruptly pointed, but becoming recurved and pungent; sepals more or less broadly lanceolate, acuminate, 1-nerved, rarely 3-nerved; petals shorter than the sepals.

Type. "Summits of hills in the Rocky Mountain range (lat. 41°). Stems about 4 inches high, forming considerable caespitose tufts. Leaves rigid, 3-nerved. Sepals unusually long and acute." Nuttall. Isotype at the New York Botanical Garden.

More than 80 per cent of the specimens reviewed have ascending, abruptly pointed leaves, and fairly broad, merely acuminate and 1-nerved sepals. There is a strong tendency toward departure from these characters in the development of recurved pungent leaves and 3-nerved narrow sepals in the remaining 20 per cent. There is, however, no correlation between this tendency

and geographic segregation, nor indeed in the coincidence of the characters themselves. Each may appear independently of the other. It does seem, though, that plants of lower altitudes tend to develop arcuate pungent leaves and attenuate tri-nerved sepals. The Nuttall type is a plant of this character.

Representative specimens. Sheep Mountains, Waterton Lake, Alberta, Canada, 1895, *J. Macoun 10100*; Bridger Mountains, Montana, June 15, 1897, *Rydberg & Bessey 4046*; Glacier National Park, Montana, July 20, 1932, *Maguire 738*; Boulder Lake, Custer County, Idaho, July 24, 1941, *Cronquist 3386*; Wyoming Range, Sublette County, Wyoming, July 18, 1922, *Payson & Payson 1922*; Buffalo, northern Wyoming, July, 1900, *Tweedy 3602*; Mt. Naomi, Cache County, Utah, August 18, 1938, *Maguire 16194*; Wasatch Plateau, Sanpete County, Utah, August 8, 1940, *Maguire 20002*; Mt. Adams, Washington, August 10, 1882, *Howell 3858* (cited as var. *gracilipes* Jones, Proc. Calif. Acad. Sci. 5: 627. 1895, but is entirely typical of subsp. *Nuttallii*); Fourth Creek, Chelan County, Washington, August 17, 1932, *Thompson 8905*.

Specimens approaching subsp. *fragilis* in leaf and/or sepal characters. Yakima Region, Washington, July, 1883, *Tweedy sine* No.; Crane Mountain, Lake County, Oregon, July 11, 1936, *Thompson 13212*; Pete's Point, Wallowa County, Oregon, July 28, 1933, *Peck 17866*; Mt. Jackson, Glacier National Park, Montana, August 24, 1926, *Somes 66*; Bush Ranch, Sweetwater County, Wyoming, June 10, 1900, *Nelson 7089*; Alta, Utah County, Utah, August 7, 1879, *Jones 1203*; Rocky Mountains, *Nuttall* (type).

1b. A. NUTTALLII Pax subsp. *fragilis* Maguire & Holmgren, subsp. nov. Caulibus 10 cm. altis, internodis foliis aequalibus; foliis 8-10 mm. longis, fere arcuatis pungentibusque; sepalis pungentibus, acuminatis, attenuatisque, 3-nerviis; petalis sepalos excedentibus aut brevioribus.

Stems about 10 cm. high, brittle, internodes equaling the leaves; leaves 8-10 mm. long, strongly arcuate and pungent, sepals pungently acuminate and attenuate, 3-nerved; petals exceeding or somewhat shorter than the sepals.

Type. Frequent, semi-denuded, loose calcareous soil with heavy clay subsoil, south-facing slopes, associated with *Artemisia tridentata* subsp. *nova*, O'Donnell Canyon, west slopes Paradise Range, 5500 feet, southwest corner Lander County, Nevada, June 12, 1945, *Maguire & Holmgren 25390*. New York Botanical Garden.

A vigorous population more upright and caespitose in habit than the other subspecies. Loose gravelly slopes at low altitudes; known in the Intermountain Region from Esmeralda and Nye counties, Nevada, Mono County, California, north to Elko and Humboldt counties, Nevada, and Malheur County, Oregon.

Representative specimens. Summit, Owens Valley, Mono County, California, May 22, 1897, *Jones sine no.*; Mt. Magruder, Esmeralda County, Nevada, June 26, 1941, *Alexander & Kellogg 2417*; Wassuk Range, Mineral County, Nevada, June 25, 1940, *Train 4151*; Ione Pass, Shoshone Range, Nye County, Nevada, June 12, 1945, *Maguire & Holmgren 25376*; hills five miles north of Reno, Washoe County, Nevada, July 1, 1907, *Heller 8657*; Star Peak, West Humboldt Mountains, Humboldt County, Nevada, July 31, 1912, *Heller 10634* (intermediate to subsp. *Nuttallii*); stony hills near Dry Creek, Malheur County, Oregon, June 10, 1901, *Cusick 2556*.

1c. *A. NUTTALLII* Pax subsp. *gracilis* (Gray) Maguire, comb. nov. *A. pungens* var. *gracilis* Gray, Proc. Am. Acad. 29: 304. 1894. *A. Nuttallii* var. *gracilis* (Gray) Robinson, Proc. Am. Acad. 29: 304. 1894.

Leaves 5–8 mm. long, pungent, strict, or the primary somewhat recurved; fascicled secondary leaves numerous; sepals 3.8–5.0 (6.0) mm. long, narrowly and pungently attenuate, 1-nerved, the nerve prominent; petals shorter than the sepals.

Type. Mountains above Big Tree Grove, California, *Bolander 4976*. Gray Herbarium.

A compact leafy and fairly uniform population of the higher mountains, the central Sierra Nevada Range south to the San Bernardino Mountains, California.

Representative specimens. Siberian Pass, Sierra Nevada, Tulare County, *Hall & Babcock 5479*; Big Pine Creek, Inyo County, July 15, 1941, *Alexander & Kellogg 2573*.

1d. *A. NUTTALLII* Pax subsp. *gregaria* (Heller) Maguire, comb. nov. *A. gregaria* Heller, Bull. S. Calif. Acad. 2: 67. 1903. *A. Nuttallii* var. *gregaria* (Heller) Jepson, Fl. Calif. 492. 1914.

Sometimes prominently stipitate-glandular throughout, particularly in the inflorescence; leaves strict or occasionally somewhat recurved, 3–8 (12) mm. long, abruptly apiculate; sepals 3.6–4.5 (4.8) mm. long, lanceolate, acuminate, 1-nerved; petals exceeding the sepals.

Type. Open stony slopes near Summit Lake, Mt. Sanhedrin, Lake County, California, July 15, 1902, *Heller 5892*. Isotype New York Botanical Garden.

Plants of gravelly ridges, slopes, and talus, from Lake County, California, northward in the coast ranges to the Siskiyou Mountains and the Mt. Shasta region.

The subsp. *gregaria* is less uniform than either subsp. *gracilis* or subsp. *fragilis*, but is not so closely intergradient with subsp. *Nuttallii* as the latter. Some forms of subsp. *gregaria* are more conspicuously long glandular-pubescent than any of the other subspecies. Its petals consistently exceed the sepals, a development occurring otherwise only in subsp. *fragilis*.

Representative specimens. Scott Mountain between Trinity and Siskiyou counties, California, July 29, 1937, *Howell 13640*; north side Mt. Shasta, Siskiyou County, California, June 11-16, 1897, *Brown 434*; Sanger Peak Lookout, Siskiyou County, California, July 7, 1939, *Hitchcock & Martin 5279*.

2. *ARENARIA FILIORUM* Maguire, Bull. Torrey Bot. Club 73: 326. 1946.

Small glabrous caespitose annuals from a slender taproot; stems slender, numerous, 2-5 cm. high, closely branching from the base upwards, at maturity becoming reddish-purple; leaves usually 5-10 mm. long, triquetrous, subcrassulus, 1-nerved or with faint lateral veins, obtuse, the pairs loosely connate at the base; inflorescence of 1 or mostly several flowers, the cymes not symmetrical, the bracts herbaceous; the sepals 3.5-4.8 mm. long, ovate-lanceolate, pink becoming purplish in age, strongly 3-nerved, the margins narrowly scarious; petals more or less equaling, or shorter than, the sepals, narrow oblong-obovate, entire; stamens included, staminal disc broad; ovules numerous; styles 3 (4); capsule shorter than the sepals, firmly chartaceous, ovate, dehiscent to the base by 3 retuse valves; seed numerous, 0.7-1.0 mm. broad, reniform, the papillae elongate, regular, low, inconspicuous, the testa dark red-brown.

This distinct species was collected in company with my son on the beach of Navajo Lake, where it was common and growing intimately with *A. rubella*.

Type locality. Common, gravelly beach, Navajo Lake, Iron County, Utah, July 13, 1940, *Maguire 19472*. New York Botanical Garden. Cotypes. Frequent, open park in aspen-spruce, 2 mi. north of Posey Lake, Aquarius Plateau, 10,000 ft., June 29, 1940, Garfield County, Utah, *Maguire 20105*; frequent, stony ridge and slopes, loose calcareous talus, head Mayfield Canyon, $\frac{1}{2}$ mi. above Ranger Station, *Maguire 19988*.

Distribution. Gravelly soils and talus, most frequently above 10,000 ft.; the southern Colorado Rockies, the high plateaus of south central Utah, and the Charleston Mountains, Clark County, Nevada.

Representative specimens. East Brian Head Peak, 11,000 ft., Iron County, Utah, June 23, 1940, *Maguire 20097*; near Ironton, San Juan County, Colorado, July 21-31, 1899, *C. C. Curtis sine no.*; Charleston Mountains, Clark County, Nevada, August 8, 1935, *Clokey 5460*.

Arenaria filiorum is habitually similar to *A. rubella*, and like this species, has strongly 3-nerved sepals. Where the two grow intimately in the same area, as frequently they do, *A. filiorum* even from a distance is instantly recognizable by its more vigorous growth and coarser appearance, altogether apart from distinction by critical characters.

Because of its total glabrosity and 1-nerved leaves, our plant may be associated with the boreal *A. Rossii*. However, in character of general habit (in the Caryophyllaceae generally of consideration) and in the important seed differences, the two stand as entirely distinct. A table of contrastive and comparative characters for these three species of *Arenaria* follows.

<i>A. rubella</i>	<i>A. filiorum</i>	<i>A. Rossii</i>
Plants wholly glandular-puberulent.	Plants wholly glabrous.	Plants wholly glabrous.
Leaves 3-nerved, not fleshy.	Leaves 1-nerved, fleshy, triquetrous.	Leaves 1-nerved, plane, not fleshy.
Flowers usually 3-5 in an open cyme.	Flowers usually 3-5 in an open cyme.	Flowers solitary.
Pedicels slender, seldom exceeding 1 cm. in length.	Pedicels slender, seldom exceeding 1 cm. in length.	Pedicels capillary, 2-4 cm. long.
Sepals strongly 3-nerved.	Sepals strongly 3-nerved.	Sepals 1-nerved, with weak lateral veins.
Seed 0.4-0.7 mm. wide, inconspicuously low-papillate, testa light red-brown.	Seed 0.7-1.0 mm. wide, papillae low, elongate, regular, testa very dark red-brown.	Seed oblong (?), 0.5-0.7 mm. long, light red-brown, almost smooth.
Circumpolar; in America extending south to Quebec and in the Rocky Mountains to New Mexico and Arizona.	Apparently concentrated in the high plateau region of south central Utah, and in addition known from the Charleston Mountains, southern Nevada, and southeastern Colorado.	Arctic America, and in the Rocky Mountains as far south as Wyoming (one doubtful record from Colorado); apparently also in easternmost Siberia.

New York Botanical Garden
New York, N. Y.

A WHITE GAILLARDIA IN TEXAS

V. L. CORY

In a "Revision of the Genus *Gaillardia*" by Susan Fry Biddulph (Research Studies, State College of Washington 12: 251, 1944), a paragraph is devoted to the treatment of the white *Gaillardia* growing in southern Hardin County, Texas, material of which had been sent to her by myself and later by my friend, Mr. P. A. Winkler, a landscape gardener and botanist of Beaumont. The author grew this plant in her garden, and the rays and disks were pure white, nevertheless she states: "Because *G. lutea* has also been collected in Hardin County, the 'white *Gaillardia*' may be only an albino form of that species." Two collections of *G. lutea*, the yellow *Gaillardia*, are cited from Hardin County by Mrs. Bid-